



REFCOMM
ROTTERDAM
30 September–3 October 2019

**ELIMINATING SHUTDOWN WATER
FLUSHING ON LARGE PROCESS UNITS**

The equipment in an operating coker is hot, dirty, and full of toxic and explosive gas.

When you shut it down for **turnaround**, it **must** be done;

SAFELY



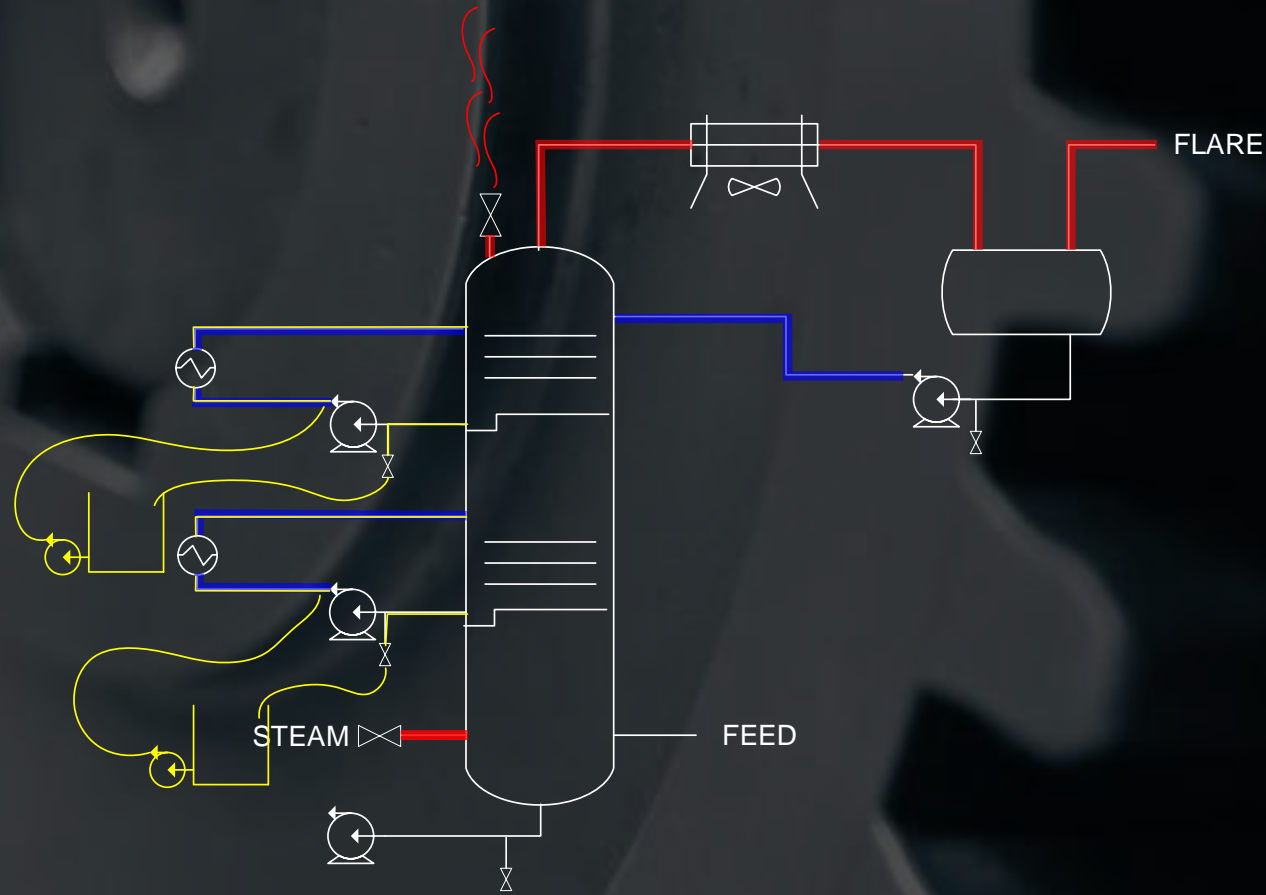
EFFICIENTLY



RAPIDLY



CANADIAN OILSANDS COKER FRACTIONATOR – LEGACY METHOD



Water flushed to remove oil

Steam to flare to “decontaminate”

Install Blinds, spools and temporary tanks & pumps and circulate soap and water

Steam to atmosphere to remove remaining benzene, LEL and H₂S

Canadian Oilsands Coker Fractionator

Water Flush Results?

SAFELY



- LEL, H2S, Benzene vented to open tanks and atmosphere - alarms
- Pyrophoric fire in overhead demister
- Oil and chemistry on ground and sewers, overflowing drain hubs
- Personnel required to wear chemical resistant suits when on the unit

EFFICIENTLY



- Substantial blinding required
- Temporary pumps, hoses and tanks rented, and effluent emulsion was very difficult to break, costly disposal for large effluent volumes (>1500m³)
- Only certain sections clean, requiring secondary cleaning DURING the turnaround

RAPIDLY



- Duration estimate was 64 hours of cleaning from “oil out” to “ready for maintenance”
- Actual time was 146 hours
- Coker frac and WGC were critical path, both delayed over 80 hours

In 2015, the turnaroud manager was directed to improve upon this performance, especially in regards to personnel safety and environmental releases.

Our company was contracted to provide a solution to decontaminate, clean and treat pyrophoric iron sulfides in this coker fractionator...it needed to be done as below

SAFELY



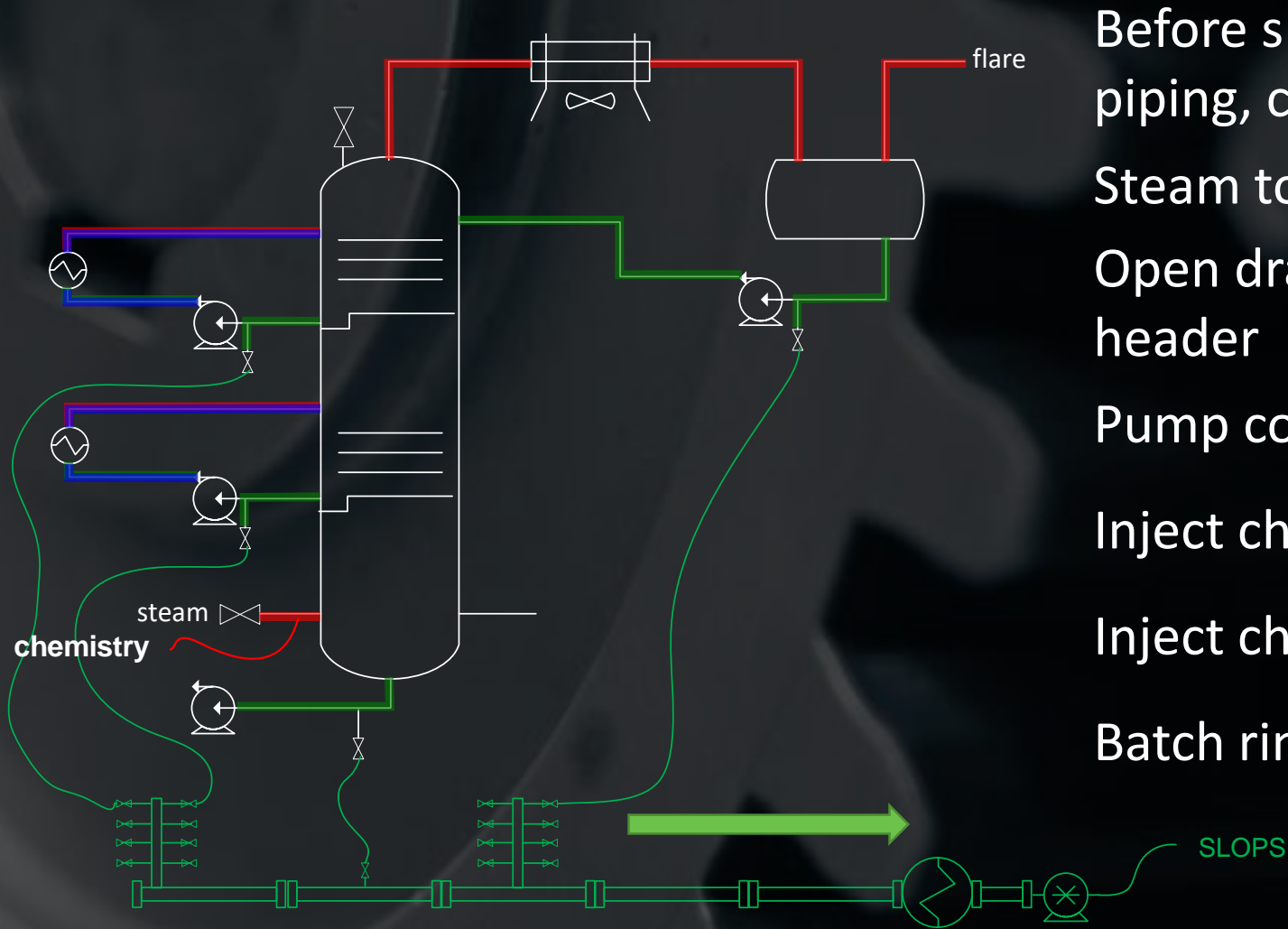
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CANADIAN OILSANDS COKER FRACTIONATOR – VAPORPHASE TO TEMPORARY CLOSED SYSTEM



Before shutdown, install temporary drain piping, cooler and pump

Steam to flare

Open drains to temporary drain header

Pump condensate and effluent to slops

Inject chemistry to remove oil, H₂S, benzene

Inject chemistry to treat pyrophorics

Batch rinse to clean and cool

SLOPS

Canadian Oilsands Coker Fractionator

Vaporphase Results?

SAFELY



- LEL, H2S, Benzene removed to slops and flare, no gas releases
- No odors, spills, gases to environment
- Tower was gas free, cool, clean and dry
- Only non-organic solids remained
- No pyrophoric activity at all
- All personnel could work without additional PPE

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- Only required small mechanical connections
- Vendor supplied drain header and hoses with all certifications
- No temporary tanks required, no effluent treatment needed, all chemistry and effluent reprocessed in slops.

RAPIDLY



- Duration for the clean was 46 hours from “oil out” to “ready for maintenance” which was 7 hours ahead of schedule
- The frac was done in parallel with the LER, WGC, blowdown

WATER FLUSHING METHOD (pre 2015)

EFFLUENT VOLUMES GENERATED

- FRACTIONATOR 1830m³
- LIGHT ENDS RECOVERY 440m³

SHUTDOWN DURATION

- 146 hours

OF FLAME RESISTANT RAIN SUITS

- 300 @ \$550 each

OF HALF MASK RESPIRATORS

- 300 @ \$65 each

OF GAS RELEASE INCIDENTS

- >20 incidents of high LEL% or H₂S hits

COST OF POST TURNAROUND CLEANING

- \$39,000
- 22 hours lost

VAPORPHASE METHOD (post 2015 and current)

EFFLUENT VOLUMES GENERATED

- FRACTIONATOR 225m³
- LIGHT ENDS RECOVERY 130m³

SHUTDOWN DURATION

- 47 HOURS

OF FLAME RESISTANT RAIN SUITS

- none

OF HALF MASK RESPIRATORS

- none

OF GAS RELEASE INCIDENTS

- None

COST OF POST TURNAROUND CLEANING

- \$0

USA NESHAP and MACT CC

In the USA, the MACT CC rules require refiners to limit venting to the atmosphere; equipment must be $<35\text{kPaG}$ and $<10\%$ LEL before opening to the atmosphere

This encouraged the use of cleaning and decontaminating equipment before opening to the atmosphere, and this is best achieved with a steam out to flare and to a closed temporary drain header system.

In the USA today, water flushing refinery units has been almost completely replaced by the vaporphase cleaning method. Not only is it better for the environment and people, it reduces shutdown timelines and allows the turnaround to start on time without having to do decontamination and cleaning DURING the turnaround maintenance activities.

Refinery shutdowns should not be considered exceptions to safe operating practices.

- High point venting to remove benzene, H₂S, and VOCs to the environment should be eliminated
- Draining oil and effluent to open containers or directly to the floor of the unit is a bad practice
- Large volumes of waste effluent are costly to contain, transport, and reprocess
- Personnel should not be exposed to dirty working environments with risk of gas exposure or pyrophoric fires



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